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Robot demonstrates self-adaptive software features

by Fran Crumb, Information Directorate

ROME, N.Y. — A mine-detecting robot has successfully demonstrated the possibility of software that automatically adjusts to failures and changes in a system.

The Air Force Research Laboratory Information Directorate and IS Robotics of Somerville, Mass., used the firm's Ariel 2 , an autonomous legged underwater vehicle, to show how robots can be made to adapt to their environment through the use of self-adaptive software (SAS) techniques.

Ariel 2 is a mine-detecting robot with six legs that can perform both on land and underwater. Research into both the robot and SAS technology is funded by the Defense Advanced Research Projects Agency of Arlington, Va.

SURF'S UP — The Ariel 2 autonomous legged underwater vehicle, a mine-detecting robot,has demonstrated the ability to adapt to its environment using self-adaptive software techniques.

"Adaptive features of the robot include tolerance for sensor inadequacy, environment adaptation, tolerance to actuator failure, and goal driven choice of behaviors," said Daniel E. Daskiewich, program manager in the directorate's Information Technology Division.

Engineers from IS Robotics tested Ariel 2 at the Naval Surface Warfare Center in Panama City, Fla., to demonstrate simulated mine detection on land and in shallow water. Metal targets were detected successfully in both environments. Walking, posturing and station keeping (walking a straight line along a compass heading) were demonstrated both partially and fully submerged.

"Making the robot adapt to its environment was the main premise behind the testing," Daskiewich said. "If parts are failing — such as one of six legs becomes inoperable — the software realizes that and adjusts for the failure. Adaptable software should be made as generic as possible for use in various applications. The self-adaptive techniques developed for Ariel 2 are directly applicable to all Air Force systems that are embedded with real time capabilities.

"Most of Department of Defense's complex systems depend on software for successful operation," Daskiewich said. "Software for these systems is easily broken or degraded by unanticipated inputs or conditions and cannot respond to changing needs.

"The development of software that modifies its own behavior in order to adapt to discovered changes in requirements, inputs, and internal and external conditions will drastically cut both the cost and time required for defense system modifications and improvements," he said. **@**